The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Jeanette Moss
Project title	Evaluating population recruitment and hatchling survivorship in Cyclura nubila caymanensis at communal nesting sites on Little Cayman Island
RSG reference	Jane Raymond
Reporting period	August 2015 – 12-month Report
Amount of grant	£4,620
Your email address	jbm650@msstate.edu
Date of this report	

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Evaluate hatching success in excavated nests and identify clear threats to neonate survivorship.			X	30 nest chambers were excavated for eggshell counts, revealing high hatching success. Snake predation at nest sites was identified as a major source of neonate mortality.
Initiate mark-recapture program to monitor long-term survivorship and dispersal of hatchling SIRI on Little Cayman.			X	228 hatchlings were captured and tagged for long-term identification.
Conduct preliminary molecular analyses of population recruitment, genetic make-up at communal nest sites.		X		218 hatchling blood samples were collected for these analyses.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

Our goals were greatly exceeded in this first field season on Little Cayman Island. The level of success was unexpected because my methods were being implemented on Little Cayman for the first time. With any field study like this, the unique attributes of a species and its habitat require customization of even the most established methods.

I was very fortunate in that several of the techniques I used required minimal modifications. Erecting corrals of aluminium flashing around previously identified egg chambers proved to be a particularly effective means for capturing emerging hatchlings. Despite the smooth operation of most captures and processing, unforeseen difficulties still arose in the execution of some follow-up analyses. For example, even when emergence holes were positively identified, rugged substrate or sheer depth occasionally rendered it impossible to completely excavate egg chambers and evaluate hatching success. In other cases involving marked nests, emergence holes were never discovered due to limited detection ability or due to failed emergence. However, due to the large observed range of incubation periods, it was deemed too risky to excavate an egg chamber after a strict date on the pretext that the nest had failed. If this assumption was incorrect, premature exposure of the eggs to ambient conditions could cause neonate mortalities. Thus, the very high hatching success observed among our 30 excavated nests could be an overestimation.

Furthermore, attempts to quantify early hatchling mortalities were extremely limited by our means of detection. For example, road traffic is presumed to be a major source of mortality for emerging hatchlings since many major communal nest sites are distributed along the coast with roads bisecting access to the island's interior. However, most hatchling roadkills are likely to go unobserved due to their small size and rapid consumption by scavengers. Further, hatchlings disperse from their natal sites quickly and appear to prefer the cover of trees and dense underbrush. As a result, more robust methodologies may be needed to investigate survivorship and dispersal within the first several weeks of life.

Finally, one of my objectives for this project was to investigate whether intrinsic factors (specifically inbreeding load) are contributing to differential hatching success or hatchling fitness (measured as body size) among clutches. While sufficiently robust samples were obtained to estimate inbreeding load in the 2015 cohort, my efforts to obtain whole-clutch samples for reconstructing parentage were less successful. In cases where maternal DNA is available, the genotypes of her progeny may be employed to discern her mating behaviours, including multiple and non-random mating. Clutches produced by such behaviours are predicted to carry lower inbreeding loads and thus, enjoy higher fitness than those produced by matings between close relatives. Unfortunately, very few of the sampled clutches could be linked to a female iguana that was also sampled earlier in the summer. The use of more efficient sampling methodologies in both the nesting season and emergence season is expected to enhance the resolution of the inferences I can make.

3. Briefly describe the three most important outcomes of your project.

The first important outcome of this project was the excavation of 30 nests on Little Cayman's West End to collect data on overall hatching success and to assess the extrinsic conditions within and around nests at their time of emergence. Half of the nests excavated had 100% hatching success (confirmed by eggshell counts) and over three-fourths had 90% or higher hatching success. Only three nests had very low hatching success (between 33% and 50%), and these failures were attributed to fire ants, poor chamber conditions, and potentially maternal age. This low variation in hatching success occurred despite extremely high variability in nest dimensions (measured as entry tunnel length, chamber depth, and overall course and shape), guarding behaviour of females, and time of incubation. Indeed, incubation periods ranged from 58 to 88 days. Within communal nest sites, snakes were a significant presence and at least five instances of direct predation were observed. Only one hatchling road kill was recorded during the month of August.

A second major outcome of this project was the initiation of a mark-recapture program to monitor long-term trends in survivorship and dispersal among SIRI juveniles—a poorly studied demographic class. Nearly 230 hatchlings were captured and tagged in the month of August, which should facilitate sufficient recapture opportunities over subsequent summers to contribute to taxon-specific knowledge of juvenile growth, survivorship, and dispersal. Of the hatchlings processed during the project period, morphometrics were fairly normally distributed but encompassed a

wide range of sizes (masses between 34 and 65 grams and snout-vent-lengths between 9.1 and 11.7 cm). Neither metric of body size was found to be correlated with any of the extrinsic factors measured (nest dimensions, female size or guarding behaviour, or incubation time). However, clutch designation was found to account for significant variation in both metrics ($p < 0.05$). This would suggest a role for intrinsic (genetic) factors in governing hatchling body size, which is often employed as a fitness proxy in lizards due to its correlation with resource acquisition, predator avoidance, and social dominance (Clobert *et al*. 2000, Le Galliard *et al*. 2004).

The third important goal of the study was to collect blood samples for investigating the impact of inbreeding depression on the population, and to examine how genetic diversity is distributed among communal nest sites. Robust multilocus genotyping of the 218 hatchlings combined with over 150 adults will be used to estimate intensity of selection against inbreeding in the population. This will be measured using the difference in heterozygote frequencies between hatchlings and adults. Furthermore, by examining multilocus genotypes within- and between-clutches and attempting to reconstruct parental genotypes, I will be able quantify the frequencies of polyandry and non-random mating as potential inbreeding avoidance strategies.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

This project could not have been carried out without the support and involvement of the Caymanian government and local community. My key collaboration was with the Cayman Islands Department of Environment (DoE), whose staff members participated in all aspects of fieldwork to learn protocols for implementing long-term monitoring of SIRI, including nest excavations and hatchling handling and measurement. I also forged a relationship with the Little Cayman National Trust by attending their meetings to share my research and perform demonstrations and also providing updated commentary on SIRI's nesting habits to facilitate land-purchasing initiatives. Another important involvement from the local community came from my fulltime volunteer, TayVanis, who was able to count his experience towards the completion of a government internship while also establishing contacts with the DoE to pursue future career opportunities.

5. Are there any plans to continue this work?

Yes, since this project was only the first phase of a multiyear Ph.D. project. I do intend to continue my work on Little Cayman, delving into many aspects of population dynamics and nesting ecology.

6. How do you plan to share the results of your work with others?

The preliminary results of my work were presented at the 2015 Iguana Specialist Group Meeting in St. Augustine, Florida. The work was also featured in Flicker, the bimonthly bulletin of the Cayman Islands. I further intend to blog my experiences on the Rufford Foundation's website and to continue pursuing opportunities to present

my research by attending scientific meetings and organizing talks with the local community on Little Cayman.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

This Rufford Foundation grant was intended for the month of August, and indeed all funds were applied towards expenses incurred over the month of August or to purchase equipment and materials prior to arriving in the field.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Airfare to Little Cayman for Personnel	2,150	2,052	98	
On-Island transportation	300	12	288	Did not have to rent vehicle; only pay fee for driver's permit
Processing supplies	1,230	1,617	-387	Budget was expanded to allow purchase of aluminium flashing for corrals
Blood sampling supplies	465	605	-140	Applied excess funds from in-kind vehicle contribution to provide further cushion to field inventory
Food for 5 weeks	475	334	141	
Total	4,620	4,620	0	

9. Looking ahead, what do you feel are the important next steps?

The first important follow up for this project will be to carry through with the mark-recapture of yearlings in the Summer of 2016 in order to investigate stage-specific survivorship and dispersal and to arrive at estimates of population size. Furthermore, I intend to expand upon nesting studies by logging incubation conditions, quantifying snake presence at communal sites, and improving methodologies to detect failed nests. A follow-up field season will also provide opportunities for increasing my maternal-clutch genetics samples in order to investigate differences in fitness controlled by intrinsic and behavioural factors.

Another effort I would like to pursue in subsequent field seasons is employing radio telemetry to track hatchling iguanas away from their natal sites for up to four weeks, which will not only provide insight into patterns of dispersal but will also allow for direct estimates of neonate survival rates. Also to this end, I am interested in involving the local community to organize a large cat-capture event on Little Cayman. Not

only will this contribute to dealing with the island's feral cat problem, but subsequent analysis of stomach contents will also serve to investigate the threats posed by cat predation.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

Yes, the Rufford Foundation logo was used in my presentation at the Iguana Specialist Group meeting in November, 2015.